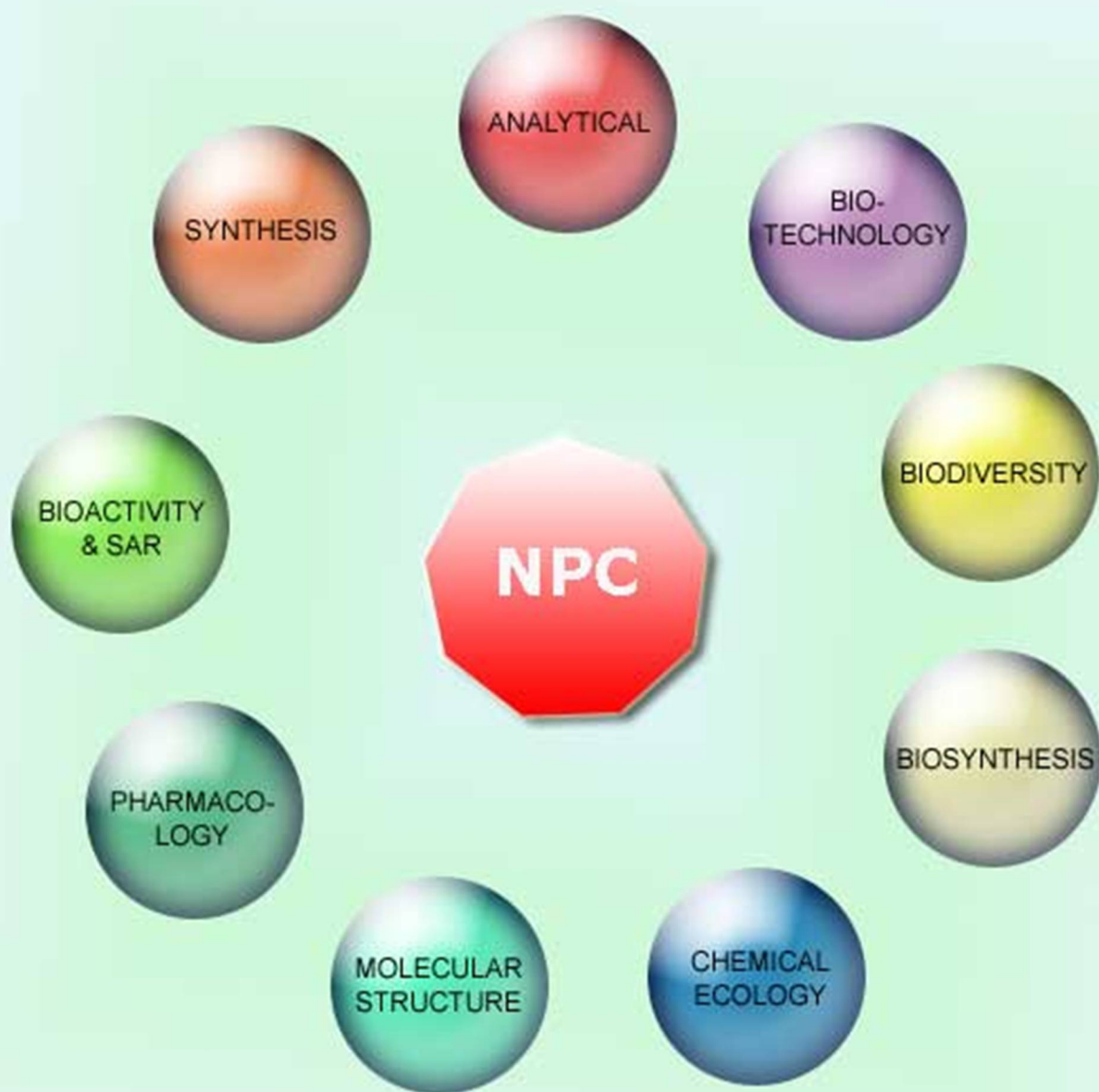


# NATURAL PRODUCT COMMUNICATIONS

An International Journal for Communications and Reviews Covering all  
Aspects of Natural Products Research



Volume 6. Issue 12. Pages 1799-1968. 2011  
ISSN 1934-578X (printed); ISSN 1555-9475 (online)  
[www.naturalproduct.us](http://www.naturalproduct.us)

**EDITOR-IN-CHIEF****DR. PAWAN K AGRAWAL**

Natural Product Inc.  
7963, Anderson Park Lane,  
Westerville, Ohio 43081, USA  
agrawal@naturalproduct.us

**EDITORS****PROFESSOR ALESSANDRA BRACA**

Dipartimento di Chimica Bioorganica e Biofarmacia,  
Università di Pisa,  
via Bonanno 33, 56126 Pisa, Italy  
braca@farm.unipi.it

**PROFESSOR DEAN GUO**

State Key Laboratory of Natural and Biomimetic Drugs,  
School of Pharmaceutical Sciences,  
Peking University,  
Beijing 100083, China  
gda5958@163.com

**PROFESSOR YOSHIHIRO MIMAKI**

School of Pharmacy,  
Tokyo University of Pharmacy and Life Sciences,  
Horinouchi 1432-1, Hachioji, Tokyo 192-0392, Japan  
mimaki@ps.toyaku.ac.jp

**PROFESSOR STEPHEN G. PYNE**

Department of Chemistry  
University of Wollongong  
Wollongong, New South Wales, 2522, Australia  
spyne@uow.edu.au

**PROFESSOR MANFRED G. REINECKE**

Department of Chemistry,  
Texas Christian University,  
Forts Worth, TX 76129, USA  
m.reinecke@tcu.edu

**PROFESSOR WILLIAM N. SETZER**

Department of Chemistry  
The University of Alabama in Huntsville  
Huntsville, AL 35809, USA  
wsetzer@chemistry.uah.edu

**PROFESSOR YASUHIRO TEZUKA**

Institute of Natural Medicine  
Institute of Natural Medicine, University of Toyama,  
2630-Sugitani, Toyama 930-0194, Japan  
tezuka@inn.u-toyama.ac.jp

**PROFESSOR DAVID E. THURSTON**

Department of Pharmaceutical and Biological Chemistry,  
The School of Pharmacy,  
University of London, 29-39 Brunswick Square,  
London WC1N 1AX, UK  
david.thurston@pharmacy.ac.uk

**HONORARY EDITOR****PROFESSOR GERALD BLUNDEN**

The School of Pharmacy & Biomedical Sciences,  
University of Portsmouth,  
Portsmouth, PO1 2DT U.K.  
axuf64@dsl.pipex.com

**ADVISORY BOARD**

Prof. Berhanu M. Abegaz  
Gaborone, Botswana

Prof. Viqar Uddin Ahmad  
Karachi, Pakistan

Prof. Øyvind M. Andersen  
Bergen, Norway

Prof. Giovanni Appendino  
Novara, Italy

Prof. Yoshinori Asakawa  
Tokushima, Japan

Prof. Lee Banting  
Portsmouth, U.K.

Prof. Julie Banerji  
Kolkata, India

Prof. Alejandro F. Barrero  
Granada, Spain

Prof. Anna R. Bilia  
Florence, Italy

Prof. Maurizio Bruno  
Palermo, Italy

Prof. César A. N. Catalán  
Tucumán, Argentina

Prof. Josep Coll  
Barcelona, Spain

Prof. Geoffrey Cordell  
Chicago, IL, USA

Prof. Cristina Gracia-Viguera  
Murcia, Spain

Prof. Duvvuru Gunasekar  
Tirupati, India

Prof. A.A. Leslie Gunatilaka  
Tucson, AZ, USA

Prof. Kurt Hostettmann  
Lausanne, Switzerland

Prof. Martin A. Iglesias Arteaga  
Mexico, D. F., Mexico

Prof. Jerzy Jaroszewski  
Copenhagen, Denmark

Prof. Leopold Jirovetz  
Vienna, Austria

Prof. Karsten Krohn  
Paderborn, Germany

Prof. Hartmut Laatsch  
Gottingen, Germany

Prof. Marie Lacaille-Dubois  
Dijon, France

Prof. Shoen-Sheng Lee  
Taipei, Taiwan

Prof. Francisco Macias  
Cadiz, Spain

Prof. Imre Mathe  
Szeged, Hungary

Prof. Joseph Michael  
Johannesburg, South Africa

Prof. Ermino Murano  
Trieste, Italy

Prof. M. Soledade C. Pedras  
Saskatoon, Canada

Prof. Luc Pieters  
Antwerp, Belgium

Prof. Peter Proksch  
Düsseldorf, Germany

Prof. Phila Raharivelomanana  
Tahiti, French Polynesia

Prof. Monique Simmonds  
Richmond, UK

Prof. Valentin Stonik  
Vladivostok, Russia

Prof. Winston F. Tinto  
Barbados, West Indies

Prof. Karen Valant-Vetschera  
Vienna, Austria

Prof. Peter G. Waterman  
Lismore, Australia

**INFORMATION FOR AUTHORS**

Full details of how to submit a manuscript for publication in Natural Product Communications are given in Information for Authors on our Web site <http://www.naturalproduct.us>.

Authors may reproduce/republish portions of their published contribution without seeking permission from NPC, provided that any such republication is accompanied by an acknowledgment (original citation)-Reproduced by permission of Natural Product Communications. Any unauthorized reproduction, transmission or storage may result in either civil or criminal liability.

The publication of each of the articles contained herein is protected by copyright. Except as allowed under national "fair use" laws, copying is not permitted by any means or for any purpose, such as for distribution to any third party (whether by sale, loan, gift, or otherwise); as agent (express or implied) of any third party; for purposes of advertising or promotion; or to create collective or derivative works. Such permission requests, or other inquiries, should be addressed to the Natural Product Inc. (NPI). A photocopy license is available from the NPI for institutional subscribers that need to make multiple copies of single articles for internal study or research purposes.

**To Subscribe:** Natural Product Communications is a journal published monthly. 2011 subscription price: US\$1,995 (Print, ISSN# 1934-578X); US\$1,995 (Web edition, ISSN# 1555-9475); US\$2,495 (Print + single site online); US\$595 (Personal online). Orders should be addressed to Subscription Department, Natural Product Communications, Natural Product Inc., 7963 Anderson Park Lane, Westerville, Ohio 43081, USA. Subscriptions are renewed on an annual basis. Claims for nonreceipt of issues will be honored if made within three months of publication of the issue. All issues are dispatched by airmail throughout the world, excluding the USA and Canada.

## Isolation of C-glycosyl Xanthones from *Coffea pseudozanguebariae* and Their Location

Pascale Talamond<sup>1,2</sup>, Geneviève Conejero<sup>3</sup>, Jean-Luc Verdeil<sup>3</sup> and Jean-Luc Poëssel<sup>4</sup>

<sup>1</sup>UMR Diversity and Adaptability of Crops, IRD, 911, avenue d'Agropolis, BP 64501, 34394 Montpellier cedex 5, France

<sup>2</sup>Current address: UMR 226 IRD-ISEM, 361, rue Jean-François Breton, BP 5095, 34196 Montpellier cedex 5, France

<sup>3</sup>UMR BPMP 5004, UMR DAP 1098, Plate-forme d'Histocytologie et Imagerie Cellulaire Végétale, avenue Agropolis, 34398 Montpellier, cedex 5, France

<sup>4</sup>UR 1052, Genetic Improvement of Fruit and Vegetables, Domaine St Maurice, 84143 Montfavet, France

[pascale.talamond@ird.fr](mailto:pascale.talamond@ird.fr)

Received: October 21<sup>st</sup>, 2010; Accepted: July 17<sup>th</sup>, 2011

The biochemical composition of leaves from *Coffea pseudozanguebariae*, a wild caffeine-free coffee species, was determined. Two phenolic compounds were extracted from leaves, separated and characterized. Their structures were elucidated by mass spectrometry, and 1D and 2D NMR spectroscopy and were shown to be mangiferin (**1**) and isomangiferin (**2**), which were the main polyphenol products. Multiphoton fluorescence imaging was performed to visualize polyphenol distribution in leaf cross sections. Consistent biochemical analysis cell imaging techniques on leaves revealed yellow fluorescence in the epidermis and parenchyma cells corresponding to xanthone compounds.

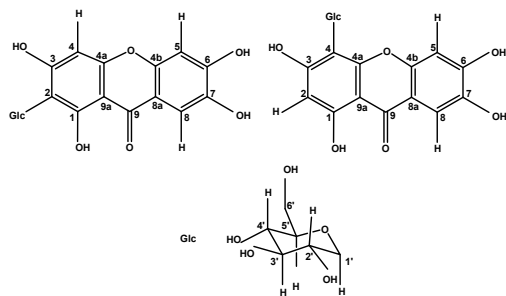
**Keywords:** *Coffea pseudozanguebariae* Bridson, xanthones, fluorescence, mangiferin, isomangiferin, Rubiaceae.

Abbreviations: hydroxycinnamoyl quinic acid, HQA, caffeoylquinic acids (3,4,5), CQA; di-caffeoyl quinic acids (3,4; 3,5; 4,5), diCQA.

*Coffea pseudozanguebariae* Bridson, native to East Africa, is a wild species of coffee tree and the first caffeine-free species discovered in tropical East Africa. It exhibits different morphological and physiological characteristics from other species of coffee: one of the shortest fruiting times [1a], low hydroxycinnamoyl quinic acid (HQA) content [1.2% dmb (dry matter basis)] [1b], morphological aspects (small purple fruits on complete ripeness and small sized leaves), and a small sized genome (1.13 pg). Previous phytochemical investigations described the presence of alkaloids, with the major component trigonelline, diterpenes (cafestol, kahweol), and phenolic compounds (HQA, hydroxycinnamoyl quinic acid, or chlorogenic acids) in *C. pseudozanguebariae*. The unsaponifiable lipid fraction of green beans contains a mozambioside, a diterpene glycoside [2], high cafestol, kahweol, and four unknown diterpenes [3]. The diterpene glycoside, which is not present in the other species of commercial coffee trees, is the origin of the strong bitterness of this coffee [2]. In the soluble fraction, two classes of secondary metabolites have been particularly studied in green coffee beans: alkaloids and phenolic compounds. The content of the major alkaloid, caffeine, varies markedly between species, from 0%, dry wt, in *C. pseudozanguebariae* to 3.2%, dry wt, in *C. canephora* [4]. Trigonelline, a major coffee aroma compound, forms

1.02%, dry wt, of *C. pseudozanguebariae*, 0.67%, dry wt, of *C. canephora*, and 0.57%, dry wt, of *C. liberica* var. *dewevrei* [5]. Only two classes of phenolic compounds have been described in coffee plants: a major one, HQA and a minor one, proanthocyanins, from the flavonoid class [6]. Other phenolic compounds are polymeric, such as tannins. Lignans are also present in coffee seeds, although in minor amounts. This main family is formed from esters between hydroxycinnamate and quinic acid. No previous study on *C. pseudozanguebariae* has been reported in the literature. In this paper, we report the first chemical investigation of *C. pseudozanguebariae* leading to the isolation of compounds including the representative phenolic compounds and the visualization of their accumulation in the tissue.

A methanolic extract of *C. pseudozanguebariae* leaves was chromatographed on a RP-18 column and showed a major peak with a retention time at 10.1 min. This peak exhibited a spectrum with four maximum UV absorbances at 240 nm, 257 nm, 316 nm, and 365 nm. The minor peak at 10.9 min had the same UV characteristics. A peak at 7.3 min was identified, with the help of UV spectra, as 5-*O*-caffeoylquinic acid (or chlorogenic acid). Semi-preparative chromatography was used to isolate the unknown compounds. After evaporation, a yellow powder



**Figure 1:** Structure of C-glucosyl xanthones. **1:** C2- $\beta$ -D-glucoside 1,3,6,7 tetrahydroxyxanthone-9-one (or mangiferin), **2:** C4- $\beta$ -D-glucoside 1,3,6,7 tetrahydroxyxanthone-9-one (or isomangiferin).

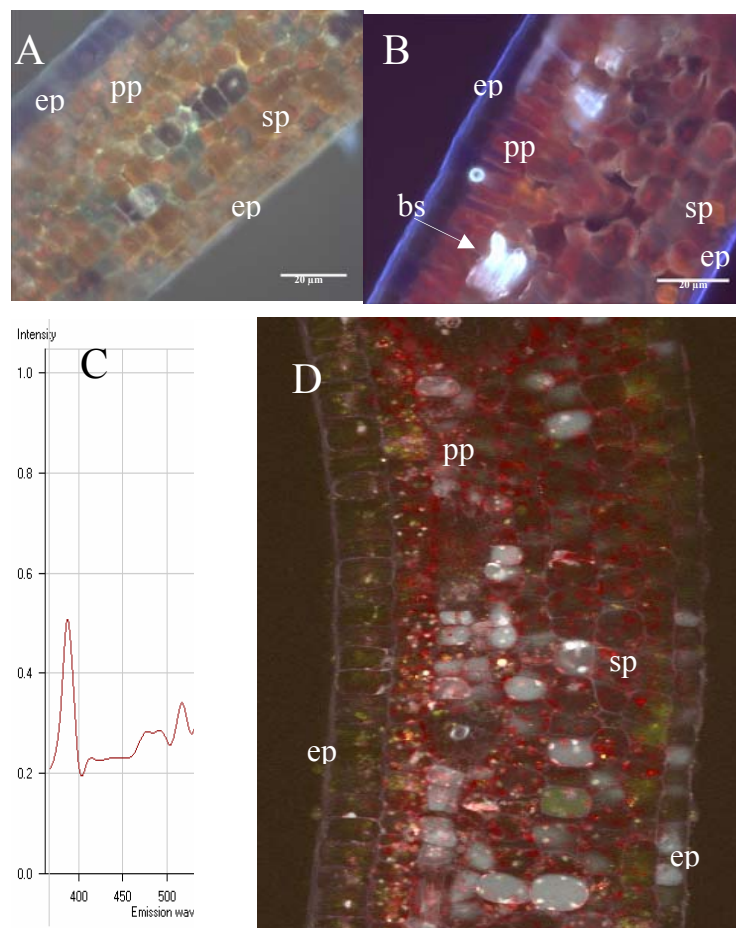
was obtained and used to carry out the first analysis for structure elucidation. Another separation system using a combination of cellulose column and Sephadex LH-20 gel filtration gave yellow crystalline materials (compounds **1**, **2**). From their physical, EI mass spectrometric and NMR spectroscopic features compound **1** was unambiguously established as 2-C- $\beta$ -D-glucopyranosyl- 1,3,5,7 tetrahydroxy-xanthone-9-one (mangiferin) [7a,7b], and **2** as 4-C- $\beta$ -D-glucopyranosyl- 1,3,5,7 tetrahydroxyxanthone-9-one (isomangiferin) [8]. Compound **2** led to a slight hypsochrome UV spectrum displacement at 318 nm. The  $^1\text{H}$  spectrum of **2** is very close to that of **1** except for signals of two aromatic protons at  $\delta_{\text{H}}$  6.02 and 6.17.

Cross-sections of fresh *C. pseudozanguebariae* leaves at two stages of development were observed by epifluorescence microscopy. The young leaves (maroon color, and less than 4 cm long) showed a yellow and orange fluorescence in all cells (Figure 2A). The mature leaves (green color) did not show such a fluorescence, except for some cells in the mesophyll, which gave an orange fluorescence (Figure 2B). It is known that phenolic compounds naturally have the ability to emit fluorescence under ultraviolet light. The autofluorescence of polyphenols was used to localize them in tissues of the leaves. In order to visualize the accumulation of phenolic compounds, a spectral analysis was developed on the same fresh leaf sections. This technique was achieved with a special detection system, which enabled separation of the signals from different fluorophores. We used this technique with a multiphotonic microscope because the infra-red laser associated with this microscope gave the possibility of exciting molecules like a UV laser. With an excitation wavelength between 700 and 800 nm, it was possible to excite like a UV laser between 350 and 400 nm. In these optical conditions, spectral signatures were acquired for each pixel of the scanned image (from either leaf section or purified compound) and could subsequently be used for digital separation into component dyes. Then, from these spectral signatures, the Linear Unmix method was used to discriminate between various fluorescence signals, even with widely overlapping emission spectra. The emission spectral curve data obtained from the compounds were recorded in a spectral library and applied on cross-sections of leaves to localize them. The

calculation was realized using a high number of iterations and by keeping a residual channel dedicated to pixels not corresponding to the selected spectral signatures. The spectral acquisition obtained on young leaf cross-sections showed a complex pattern of autofluorescence resulting from various fluorescent compounds. The fluorescence observed in young leaves, identified as the spectrum emission of mangiferin, was found after Linear Unmixing calculation in the upper epidermis and in some mesophyll cells (Figure 2C). The same technique was used with the spectrum emission of 5-O-caffeoylquinic acid (chlorogenic acid), the main phenolic compound in coffee, but no signal was detected on the leaves (data not shown). There were other uncharacterized fluorescent compounds in the mesophyll, which did not correspond to the known compounds and which seems to belong to other families of secondary metabolites. These compounds are not accumulated in the leaves of *C. arabica* and *C. canephora*, the commercial species of coffee. The decrease in yellow fluorescence observed between the very young and mature leaves may tally with biochemical analysis [9], in particular, during leaf development; there is a sharp decrease in the main phenolic compound, mangiferin. Consequently, tissue-specific localization could provide valuable information for understanding the actual role in the mechanisms of acclimatization to several environmental agents such as UV radiation or against pathogen and predator attacks. The fluorescent technologies now available allow researchers to study such dynamic processes in living cells.

## Experimental

**General experimental procedures:** Chromatographic separation was performed using a HPLC series (Shimadzu, Prominence LC) equipped with software, a DGU-20A<sub>3</sub> degasser, an LC-20AD binary gradient pump, a SIL-20AC thermoautosampler, and a SPD-M20A diode array detector. The column used was a LiChrospher 5  $\mu\text{m}$  RP18 (250X4 mm i.d.) from Merck (Darmstadt, Germany), and a guard column of the same material. The mobile phase consisted of 2mM phosphoric acid in water (eluent A) and MeOH (eluent B). The gradient program was as follows: a 25-80% MeOH gradient over 40 min at a flow rate of 0.8 mL.min<sup>-1</sup>. Separation was at room temperature and the injection volume was 500  $\mu\text{L}$  for isolation and 20  $\mu\text{L}$  for identification. Phenolic compounds were identified by comparing their retention times with appropriate standards: 5-caffeoyl quinic acid, 3-caffeoyl quinic acid and 3,5-dicaffeoylquinic acid. A Q-TOF Micromass (Waters, Milford, MA, USA) mass spectrometer was used to obtain the MS data. The sample was solubilized in 50% water-acetonitrile solution, acidified using 0.1% trifluoroacetic acid solution and introduced at a flow rate of 5  $\mu\text{L min}^{-1}$ . All the analyses were performed using an electrospray ionisation source (ESI) set to 100°C in positive ion mode with the following settings: capillary voltage -3000 V, cone voltage = 30 and 50 V, nebuliser gas ( $\text{N}_2$ ) 400 L/h, desolvation temperature 120°C, drying gas ( $\text{N}_2$ ) 20 l/h.



**Figure 2:** Histological imaging of fluorescent compound accumulation in the leaves of *C. pseudozanguebariae*. Cross-sections of young leaves (A) and mature leaves (B) by epifluorescence microscopy under UV light (long-pass filter 425 nm, real colours). Cross-sections of young leaves by spectral analysis and linear unmixing (C) on a multiphotonic microscope (false colors, yellow: mangiferin, red: chlorophyll, white: unknown). ep: epidermis, pp: palisade parenchyma, sp: spongy parenchyma, bs: bundle sheath cell, bar = 20  $\mu$ m.

Mass spectra were monitored using MassLynx4.0 software, with an acquisition rate of 2 spectra  $s^{-1}$  in the range  $m/z$  = 70-600. NMR spectra were measured using a Bruker DRX-400 spectrometer at 400 MHz ( $^1H$ ) and 100 MHz ( $^{13}C$ ).

**Histology:** Thick cross-sections (50  $\mu$ m) were obtained from young leaves of *Coffea pseudozanguebariae* using a vibratome (MICROM) and then dipped in 10 mM phosphate buffer saline (7 mM  $Na_2HPO_4$ , 3 mM  $NaH_2PO_4$ , 120 mM NaCl, 2.7 mM KCl). Epi-fluorescence microscopy was carried out on a Leica DMRXA equipped with a Q-Imaging camera (long-pass filter 425 nm). A Zeiss 510 META NLO multiphoton microscope equipped with a Coherent Chameleon Ultra II laser was used to obtain emission fluorescence from fresh leaves. Spectral analysis was carried out using the autofluorescence properties of polyphenol compounds without any dyes. Reference spectra on purified powder of polyphenol compounds (HQA and xanthenes) were obtained from spectral acquisition with  $\square\square$ excitation at 780 nm and  $\square\square$ emission between 400 and 700 nm. The Linear Unmixing Function of the microscope (method of

Emission Finger printing from Zeiss) was used to visualize the fluorescence of polyphenol compounds in cells from reference spectra.

**Plant material:** In these experiments we used *Coffea* plants from the collection cultivated at the IRD research centre in Montpellier (France). Leaves of *C. canephora* (DB56, DB57) and *C. pseudozanguebariae* (H65, H70) of various genotypes were taken from trees maintained in a tropical greenhouse (natural daylight, 25°C, 28°C day, 78-82% humidity). The young leaves, under 4 cm long, were cut from the tips of branches. Leaves were harvested from 5 different genotypes and 500 g of the collected leaves were frozen in liquid nitrogen immediately after collection then stored at -80°C. Each batch of leaves was freeze-dried for 48 h then stored in a cold room. *C. pseudozanguebariae* fruits were harvested at the CNRA Station in Divo (Ivory Coast) from field-grown trees.

**Extraction and isolation:** Fine powder of leaves and beans was obtained in an analytical grinder (IKA, yellow, A10) by grinding for 1 min, repeated 3 times. The leaf powders (2 g) were extracted with 70% MeOH solution (30 mL, X3) at 4°C and bean powders (50 mg) in 5 mL of 70%

MeOH solution. The MeOH extracts were combined, filtered and evaporated under reduced pressure to give a residue. This was suspended in MeOH and filtered through a 0.2- $\mu$ m disposable filter tip-syringe assembly and directly analysed by HPLC for separation and identification. A second technique was used with 80 g of freeze-dried leaves suspended in 700 mL of MeOH-H<sub>2</sub>O (8:2) solution at room temperature for 20 min with sonication (20 min, 24 KHz, R.E.U.S.-GEX 180, Contes, France), repeating 3 times. MeOH was removed in a rotavapor. After freeze-drying, the aqueous phase was subjected to a Medium Pressure (MP) column (400X47 mm) packed with cellulose (microcrystallin Avicel,

Darmstadt, Germany) and successively eluted with H<sub>2</sub>O and H<sub>2</sub>O-MeOH (1:9). Collected fractions were purified on a Sephadex LH-20 (Fluka) column (500 X 25 mm, Fluka, Basel, Switzerland) and eluted with H<sub>2</sub>O for compound **1**. For compound **2**, fractions were purified on a MP column (210 X 30 mm, Buchi) eluted with EtOH- H<sub>2</sub>O (8:2). After freeze-drying, both compounds (**1** and **2**) were obtained.

**Acknowledgements** - The authors thank Dr Maryse Bejaud for support in NMR analysis and helpful discussion. We wish to thank Elisabeth Ambert for assistance in checking bibliographic databases and for valuable help.

## References

- [1] (a) Akaffou DS, Ky CL, Barre P, Hamon S, Louarn J, Noirot M. (2003) Identification and mapping of a major gene (Ft1) involved in fructification time in the interspecific cross *Coffea pseudozanguebariae* x *C. liberica* var. 'dewevrei': impact on caffeine content and seed weight. *Theoretical Applied Genetics*, **106**, 1486-1490; (b) Ky CL, Louarn J, Guyot B, Charrier A, Hamon S, Noirot M. (1999) Relations between and inheritance of chlorogenic acid contents in an interspecific cross between *Coffea pseudozanguebariae* and *C. liberica* var. 'dewevrei'. *Theoretical Applied Genetics*, **98**, 628-637.
- [2] Prewo R, Guggisberg A, Lorenzi-Riatsch A, Baumann TW, Wettstein-Bättig M. (1990) Crystal structure of mozambioside, a diterpene glycoside of *Coffea pseudozanguebariae*. *Phytochemistry*, **29**, 990-992.
- [3] de Roos B, van der Weg G, Urgert R, van de Bovenkamp P, Charrier A, Katan MB. (1997) Levels of cafestol, kahweol, and related diterpenoids in wild species of the coffee plant *Coffea*. *Journal of Agricultural and Food Chemistry*, **45**, 3065-3069.
- [4] Anthony F, Noirot M, Clifford MN. (1993) Biochemical diversity in the genus *Coffea* L.: Chlorogenic acids, caffeine, and mozambioside contents. *Genetic Resources and Crop Evolution*, **40**, 61-70.
- [5] Ky CL, Guyot B, Louarn J, Hamon S, Noirot M. (2001) Trigonelline inheritance in the interspecific cross between *Coffea pseudozanguebariae* x *C. liberica* var. dewevrei cross. *Theoretical Applied Genetics*, **102**, 630-634.
- [6] Clifford MN, Gibson CL, Rakotomalala JJ, Cros E, Charrier A. (1991) Caffeine from green beans of *Mascarocoffea*. *Phytochemistry*, **30**, 4039-4040.
- [7] (a) Fujita, M., Inoue, T. (1982) Studies on the constituents of *Iris florentina* L.II.- C-Glucosides of xanthenes and flavones from the leaves. *Chemical & Pharmaceutical Bulletin*, **30**, 2342-2348; (b) Catalano S, Lushi S, Flamini G, Cioni PL, Nieri EM, Morelli I. (1996) A xanthone from *Senecio mikanioides* leaves. *Phytochemistry*, **42**, 1605-1607.
- [8] de Beer D, Jerz G, Joubert E, Wray V, Winterhalter P. (2009) Isolation of isomagiferin from honeybush (*Cyclopia subternata*) using high-speed-counter-current chromatography and high-performance liquid chromatography. *Journal of Chromatography A*, **1216**, 4282-4289.
- [9] Bertrand C, Noirot M, Doubeau S, de Kochko A, Hamon S, Campa C. (2003) Chlorogenic acid content swap during fruit maturation in *Coffea pseudozanguebariae*. Qualitative comparison with leaves. *Plant Science*, **165**, 1355-1361.

<b>Ferric Reducing, Antiradical and <math>\beta</math>-Carotene Bleaching Activities of Nicotinic Acid and Picolinic Acid Bioconjugates of Curcumin</b>	
Archana Pandey, Kanti Bhooshan Pandey, Ravindra Kumar Gupta and Syed Ibrahim Rizvi	1877
<b>Antiviral Activities of Diarylheptanoids Isolated from <i>Alpinia officinarum</i> against Respiratory Syncytial Virus, Poliovirus, Measles Virus, and Herpes Simplex Virus Type 1 <i>in vitro</i></b>	
Katsuhiko Konno, Rie Sawamura, Yi Sun, Ken Yasukawa, Tomomi Shimizu, Wataru Watanabe, Masahiko Kato, Ryuichi Yamamoto and Masahiko Kurokawa	1881
<b>Isolation of C-glycosyl Xanthenes from <i>Coffea pseudozanguebariae</i> and Their Location</b>	
Pascale Talamond, Geneviève Conejero, Jean-Luc Verdeil and Jean-Luc Poëssel	1885
<b>Antifungal Activity and Isomerization of Octadecyl <i>p</i>-coumarates from <i>Ipomoea carnea</i> subsp. <i>fistulosa</i></b>	
Eugene Sebastian J. Nidiry, Girija Ganeshan and Ankanahalli N. Lokesh	1889
<b>New Glucose Esters from the Fresh Leaves of <i>Jacaranda mimosaeifolia</i></b>	
Christianah A. Elusiyan and Tiwalade A. Olugbade	1893
<b>Shamiminol: A New Aromatic Glycoside from the Stem Bark of <i>Bombax ceiba</i></b>	
Shaheen Faizi, Sadia Zikr-Ur-Rehman and Muhammad Ali Versiani	1897
<b>Two New Phenolic Glycosides from <i>Viburnum plicatum</i> var. <i>plicatum</i> f. <i>plicatum</i></b>	
Saki Katagiri, Yoshiki Watanabe, Yasunori Yaoita, Masao Kikuchi and Koichi Machida	1901
<b>Antimicrobial Chemical Constituents from the Endophytic Fungus <i>Phomopsis</i> sp. from <i>Notobasis syriaca</i></b>	
Hidayat Hussain, Michel Kenne Tchime, Ishtiaq Ahmed, Kathrin Meier, Michael Steinert, Siegfried Draeger, Barbara Schulz and Karsten Krohn	1905
<b>Phomosines H–J, Novel Highly Substituted Biaryl Ethers, Isolated from the Endophytic Fungus <i>Phomopsis</i> sp. from <i>Ligustrum vulgare</i></b>	
Karsten Krohn, Umar Farooq, Hidayat Hussain, Ishtiaq Ahmed, Joachim Rheinheimer, Siegfried Draeger, Barbara Schulz and Teunis van Ree	1907
<b>Isolation and Characterization of a new Benzofuran from the Fungus <i>Alternaria</i> sp. (HS-3) Associated with a Sea Cucumber</b>	
Xuekui Xia, Jun Qi, Fang Wei, Airong Jia, Wenpeng Yuan, Xiumei Meng, Miansong Zhang, Changheng Liu and Changyun Wang	1913
<b>Potent Toxic Macrocyclic Trichothecenes from the Marine-Derived Fungus <i>Myrothecium verrucaria</i> Hmp-F73</b>	
Li Zhao, Li Liu, Nan Wang, Shu-Jin Wang, Jing-Chun Hu and Jin-Ming Gao	1915
<b>Synthesis and Bioactivity of Novel Coumarin Derivatives</b>	
Ai-Ying Guan, Chang-Ling Liu, Miao Li, Zhi-Nian Li, Ming-Xing Zhang and Hong Zhang	1917
<b>Kinase Inhibitory, Haemolytic and Cytotoxic Activity of Three Deep-water Sponges from North Western Australia and their Fatty Acid Composition</b>	
Ana Zivanovic, Natalie J. Pastro, Jane Fromont, Murray Thomson and Danielle Skropeta	1921
<b>Antimicrobial and Cytotoxic Effects of Mexican Medicinal Plants</b>	
Maria del Rosario Jacobo-Salcedo, Angel Josabad Alonso-Castro, Luis A. Salazar-Olivo, Candy Carranza-Alvarez, Luis Ángel González-Espíndola, Fabiola Domínguez, Sandra Patricia Maciel-Torres, Concepción García-Lujan, Marisela del Rocio González-Martínez, Maricela Gómez-Sánchez, Eduardo Estrada-Castillón, Rocio Zapata-Bustos, Pedro Medellín-Milán and Alejandro García-Carrancá	1925
<b>Chemometrics Evaluation of the Herbal Drug <i>Andrographis paniculata</i></b>	
Shiv Narayan Sharma, Zenu Jha and D. K. Sharma	1929
<b><i>Garcinia cambogia</i> Leaf and Seawater for Tannase Production by Marine <i>Aspergillus awamori</i> BTMFW032 under Slurry State Fermentation</b>	
Beena P. S, Soorej M. Basheer, Sarita G. Bhat and Chandrasekaran M	1933
<b>Gas Chromatographic Quantitative Analysis of Methanol in Wine: Operative Conditions, Optimization and Calibration Model Choice</b>	
Rosario Caruso, Grazia Laura Gambino, Monica Scordino, Leonardo Sabatino, Pasqualino Traulo and Giacomo Gagliano	1939
<b>Composition and Biological Potential of Essential Oil from <i>Thelechitonina trilobata</i> Growing in South Africa</b>	
Jamie Peebles, Ephraim Gwebu, Opeoluwa Oyediji, Sarah Nanyonga, Nokuthula Kunene, David Jackson, William Setzer and Adebola Oyediji	1945
<b>Chemical Composition and Antibacterial Activity of Essential oil from <i>Salvia mukerjeei</i></b>	
Lalit Mohan, Anuradha Negi, Anand B. Melkani and Vasu Dev	1949
<b><u>Review/Account</u></b>	
<b>Revealing Indigenous Indonesian Traditional Medicine: Anti-infective Agents</b>	
Ari S. Nugraha and Paul A. Keller	1953



# Natural Product Communications

## 2011

Volume 6, Number 12

### Contents

<u>Original Paper</u>	<u>Page</u>
<b>Sibiralactone: A New Monoterpene from <i>Sibiraea angustata</i></b> Guangbo Xie, Xianlong Wang, Tibor Kurtán, Attila Mándi and Tianzhi Wang	1799
<b>Bioconversion of Proposed Precursors into Theobroxide and Related Compounds</b> Peng Li, Kosaku Takahashi, Ahmed Elkhateeb, Hideyuki Matsuura, Teruhiko Yoshihara and Kensuke Nabeta	1801
<b>Microbial Hydroxylation of <i>S</i>-(-)-Perillyl Alcohol by <i>Fusarium heterosporium</i></b> Ismail Kiran	1805
<b>A Phytochemical Investigation of <i>Zanthoxylum setulosum</i></b> Tameka M. Walker, Bernhard Vogler, Debra M. Moriarity, William A. Haber and William N. Setzer	1807
<b>Cytotoxic Cembranoids from the Red Sea Soft Coral <i>Sarcophyton glaucum</i></b> Mohamed-Elamir F. Hegazy, Ahmed A. El-Beih, Alaa Y. Moustafa, Abdelhamed A. Hamdy, Montaser A. Alhammad, Rehab M. Selim, Mohamed Abdel-Rehim and Paul W. Paré	1809
<b>C-Lactam Derivatives of Oleonic Acid. The synthesis of C-lactam by Beckmann rearrangement of C-oxime</b> Barbara Bednarczyk – Cwynar	1813
<b>Analysis of Native Carotenoid Composition of Sweet Bell Peppers by Serially Coupled C<sub>30</sub> Columns</b> Daniele Giuffrida, Paola Dugo, Giacomo Dugo, Germana Torre and Luigi Mondello	1817
<b>New Antifungal Cholestane and Aldehyde Derivatives from the Red Alga <i>Laurencia papillosa</i></b> Walied M. Alarif, Sultan S. Al-Lihaibi, Ahmed Abdel-Lateff and Seif-Eldin N. Ayyad	1821
<b>Steroidal Saponins from the Fruits of <i>Cestrum ruizteraniamum</i></b> Elier Galarraga M., Anne-Claire Mitaine-Offer, Juan Manuel Amaro-Luis, Tomofumi Miyamoto, Chiaki Tanaka, Laurent Pouységu, Stéphane Quideau, Luis B. Rojas and Marie-Aleth Lacaille-Dubois	1825
<b>Isolation and Cholinesterase Activity of Amaryllidaceae Alkaloids from <i>Nerine bowdenii</i></b> Lucie Cahliková, Stanislav Zavadil, Kateřina Macáková, Irena Valterová, Andrea Kulhánková, Anna Hošťálková, Jiří Kuneš and Lubomír Opletal	1827
<b>HPLC Determination of Majdine in <i>Vinca herbacea</i></b> Natia Gagua, Beatrice Baghdikian, Fathi Mabrouki, Riad Elias, Valentina Vachnadze, Aliosha Bakuridze and Evelyne Ollivier	1831
<b>Pyridine Metabolism and Trigonelline Synthesis in Leaves of the Mangrove Legume trees <i>Derris indica</i> (<i>Millettia pinnata</i>) and <i>Caesalpinia crista</i></b> Yuling Yin, Hamako Sasamoto and Hiroshi Ashihara	1835
<b>Anti-adipogenic Activity of <i>Cordyceps militaris</i> in 3T3-L1 Cells</b> Qing Liu, In Pyo Hong, Mi-Jeong Ahn, Hwan-Soo Yoo, Sang-Bae Han, Bang Yeon Hwang and Mi Kyeong Lee	1839
<b>Two New Cyclopeptides and One New Nonenolide from <i>Xylaria</i> sp. 101</b> Yao-Yao Li, Zhi-Yu Hu, and Yue-Mao Shen	1843
<b>A Novel Flavonoid and Furoquinoline Alkaloids from <i>Vepris glomerata</i> and their Antioxidant Activity</b> Joyce J. Kiplimo, Md. Shahidul Islam and Neil A. Koorbanally	1847
<b>Flavonoid Constituents and Free Radical Scavenging Activity of <i>Alchemilla mollis</i></b> Antoaneta Trendafilova, Milka Todorova, Milena Nikolova, Anna Gavrilova and Antonina Vitkova	1851
<b>Ultrasound-assisted Extraction of Total Phenols and Flavonoids from Dry Tobacco (<i>Nicotiana tabacum</i>) Leaves</b> Ivana T. Karabegović, Vlada B. Veljković and Miodrag L. Lazić	1855
<b>Characterization of Polyphenolic Compounds in Unripe Chinotto (<i>Citrus myrtifolia</i>) Fruit by HPLC/PDA/ESI/MS-MS</b> Monica Scordino, Leonardo Sabatino, Adalgisa Belligno and Giacomo Gagliano	1857
<b>Bioactive Compounds, RP-HPLC Analysis of Phenolics, and Antioxidant Activity of Some Portuguese Shrub Species Extracts</b> Ángelo Luís, Fernanda Domingues and Ana Paula Duarte	1863
<b>HPLC/PDA/ESI-MS Evaluation of Saffron (<i>Crocus sativus</i> L.) Adulteration</b> Leonardo Sabatino, Monica Scordino, Maria Gargano, Adalgisa Belligno, Pasqualino Traulo and Giacomo Gagliano	1873

Continued inside backcover